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We sought no more hospitality after that. When in force, we took food and paid for it.

One day we were in the mountains, climbing a rocky path, when, suddenly reaching the crest of a hill, we saw beneath our feet a small army—hussars in front, a carriage next, a staff, several carriages, some infantry, and then two squadrons of hussars. We knew what it was: it was the sad remnant of Hungary's heroes. The reader may imagine our hurry to descend the hill, which we did by a mountain-path that brought us out on the road ahead of the army. We were in an instant made prisoners, and taken back to the front carriage, in which sat a man in a gray blue coat, with gold embroidery, torn by bullets and sabres, with a Kossuth hat on his head. It was Bem.

"Good day, lieutenant," said he to me, and then his eyes dilated with surprise: "Miss Katerina B—, have you escaped?"

"Miss!" I exclaimed, wild with surprise, while my com-

panion smiled and blushed, and the old general and his staff laughed heartily at my unfeigned astonishment.

I was overwhelmed with confusion, but it would have been pleasant to remark the change in my manner to my companion in misfortune. I treated her at once as a woman, and was rejoiced when she joined a party of refugee ladies. I then heard that, after joining the army with her brother and father, she was, by the death of them, left alone in the world; she would not leave the army, and her sex and courage had been universally respected.

Our journey over those hills, through the Carpathian mountains, those glorious scenes, our dangers, and our difficulties, are historical. At last we crossed the Turkish frontier, and were welcomed gladly by the peasantry and authorities; and will the reader be surprised to learn, considering her forlorn position in that country, that I found a priest, and was married to my present good and gentle wife, on the very first evening I spent in Wallachia?

SUGAR REFINING.

The sugar cane (*Saccharum officinarum*) is a plant of the botanical order *Gramineæ*, and varies in height from eight to ten or even twenty feet. It is about an inch and a half in diameter, with a stem of a green hue, verging to yellow as it approaches to maturity, and divided into annular joints of a whitish yellow colour, about three inches apart. The cane is of a dense and brittle character, decorated with long, flat, straight, pointed leaves, three or four feet in length, which fall off as the plant ripens. It is propagated either by seeds or cuttings, and is found in a wild state in the West India islands and the adjacent continent, and in many parts of the eastern hemisphere, which was its original home. Towards the end of the thirteenth century it was conveyed to Arabia, Egypt, Asia Minor, and the Barbary States. In 1506 it was imported into St. Domingo, and thence spread throughout the surrounding regions. Humboldt asserts that it was transplanted into Cyprus, and thence into Sicily. The history of the plant, the product of which is now so well known, may be briefly stated. It is related by Laftan, that in 1148, William II. king of Sicily made a present to the monastery of St. Benoit of a mill for crushing the cane; and that sugar was known to the first crusaders, who being short of provisions at Acre and Tripoli, were obliged to chew the cane to support life. In 1420, Don Henry, Regent of Portugal, imported sugar into Madeira from Sicily, whence it found its way by an easy transition to the Canaries, from which islands, before the discovery of America, Europe obtained its supply. From the Canaries the sugar cane passed to the Brazils and the West Indian islands; and towards the middle of the seventeenth century, sugar was sent to England from Barbadoes. From this period, a regular supply has been exported from the West Indies, Mexico, Peru, Spanish America, and the French and Dutch colonies. According to Peter Martyr, who wrote the third book of his first Decade during the second expedition of Columbus, either he himself introduced the cultivation of the sugar plant, or found it among the arts practised by the natives of the then unknown land.

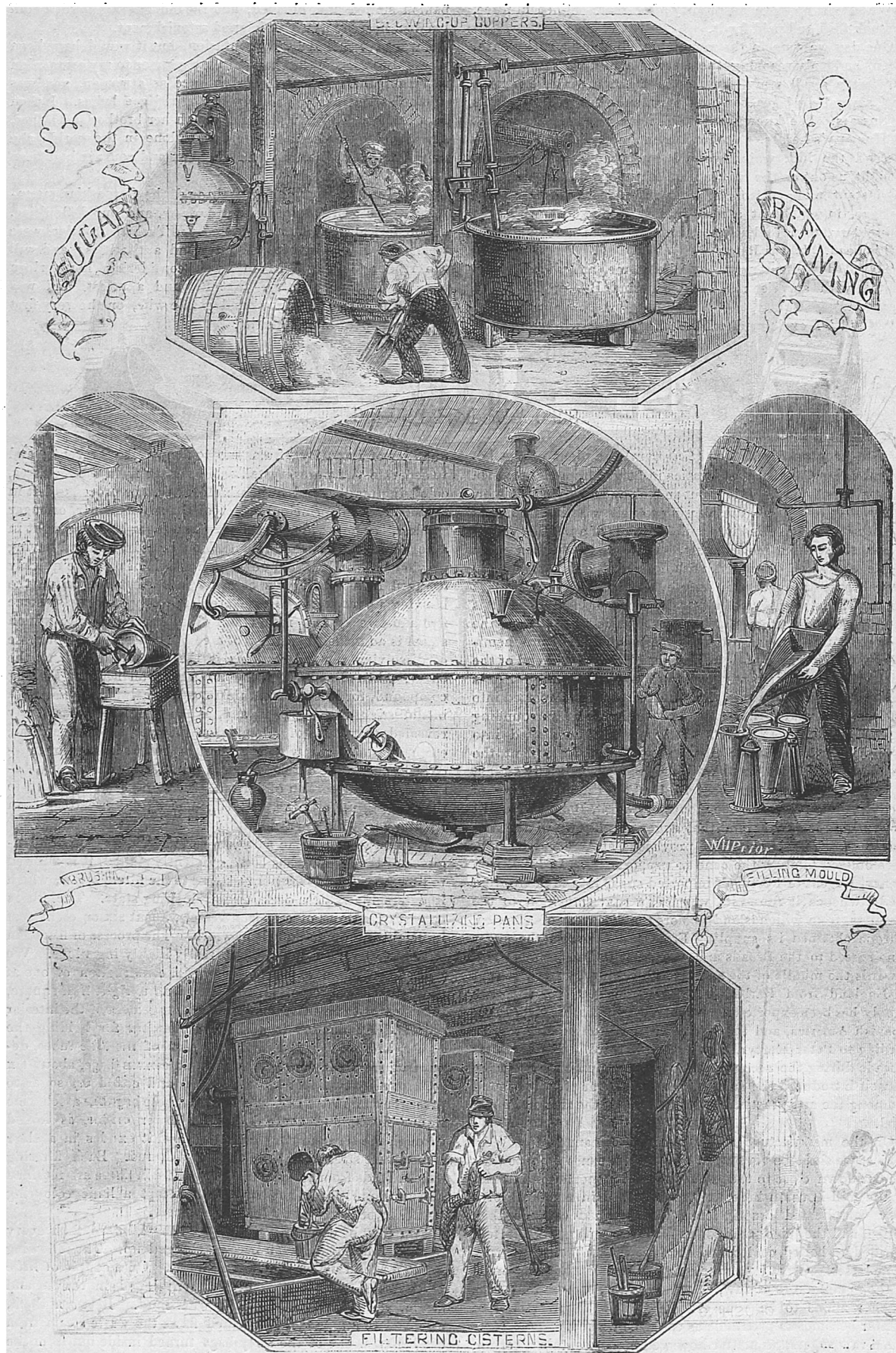
On the manufacture of sugar from the cane in the West Indies, we shall be very brief. When the canes are ripe they are cut down close to the ground, and transported in bundles to the mill-house, where they are crushed in machines of a very complicated description. The crushed cane is then boiled, and the juice, as it comes from the boiler, is collected, clarified, re-boiled, cooled, and finally separated from the syrup, or molasses. Great improvements are constantly being made in the manufacture of raw, or brown sugar, though doubtless much remains to be done ere the estate of the West Indian planter becomes as profitable as could be wished.

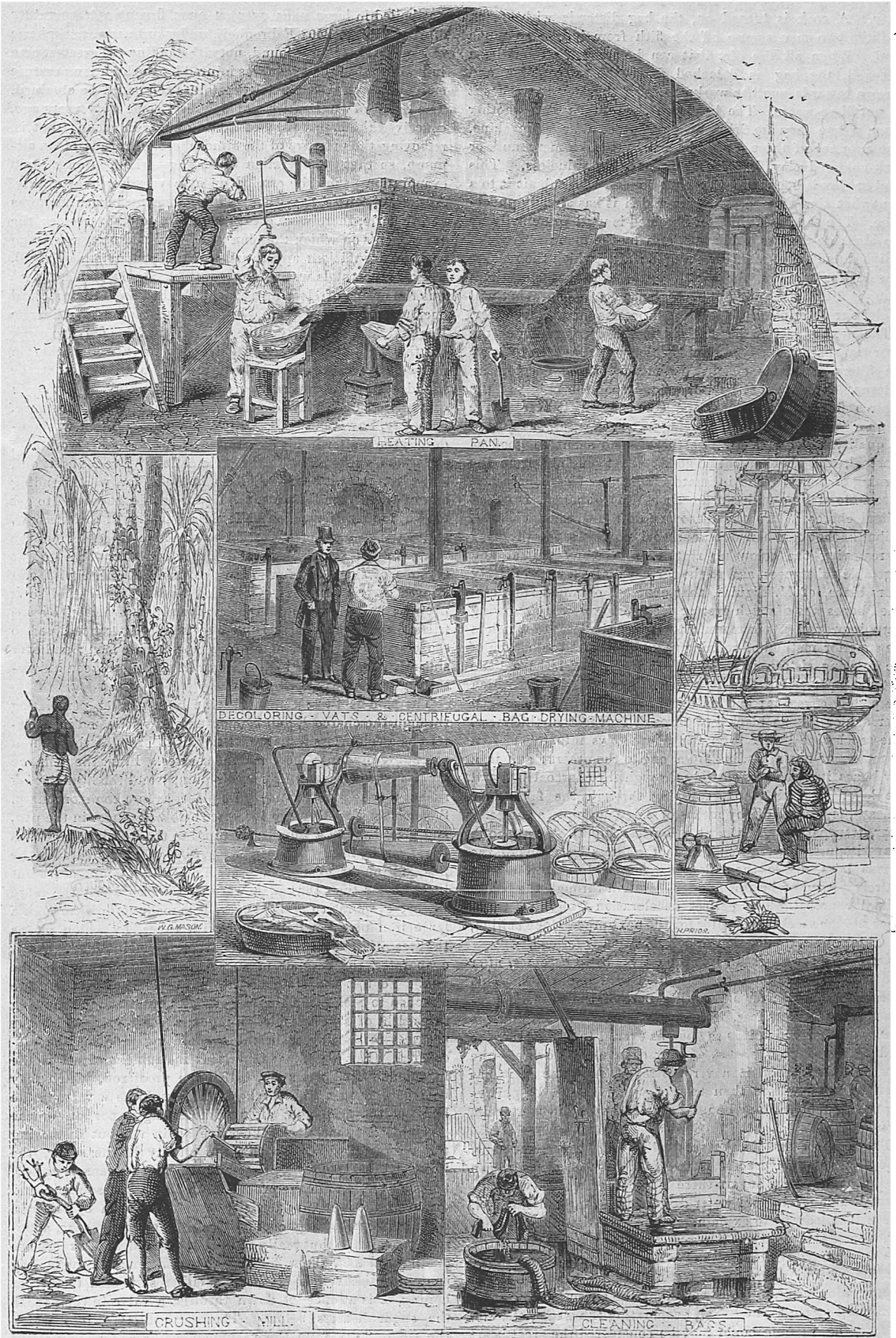
All raw sugars, no matter how well made, contain a certain

quantity of impurity—from one to about six per cent.; and to separate the pure crystallisable matter from the molasses, colouring matter, and filth, which the former processes left in the sugar, is the principal object of the sugar refiner, or sugar "baker," as he is vulgarly called. The sugar being brought in a hogshead, the hogshead is tilted on its side, its head having previously been knocked out, and a couple of men are quickly engaged in shovelling its contents into what are called the blowing-up coppers. These are large copper vessels, some five-and-twenty feet round and five feet high, into which steam is admitted, by means of a coil of pipes, for the purpose of dissolving the sugar. This is the first process; and the sugar, when dissolved, is by no means an inviting-looking compound, for it is a dark, thick, muddy, calming liquid, with bits of sticks floating in it, and, as the microscope has lately revealed, thousands of animalcules. As yet, the gluten, lime, earth, and molasses, which are always present in raw, or muscovado, sugar, are unremoved, and the substance is simply dissolved, a small portion of lime-water having been admitted to the blowing-up cisterns, and constant agitation having been used to assist the operation.

When the saccharine solution, called "liquor" in the language of the factory, has been sufficiently melted, it is allowed to flow from the blowing-up cisterns to the filters below, which it enters in a thick, dark, treacly-looking state. The filters consist of a series of cast-iron vessels, about six or eight feet in height by two and a half in width. The process of filtration is not only very complete, but really highly ingenious. We will endeavour to explain the internal construction of one of these filtering cisterns. It consists of an upright iron square, furnished with an outer door for the arrangement of the interior objects. At the top is a shallow chamber for holding the liquor, and to this is attached a series of metallic tubes, depending from which are several stout canvas bags, about six feet long by two feet wide, doubled and coiled up so as to present a compact mass of cloth. Into these bags the saccharine liquor flows, and there being no lower orifice, is forced through the structure of the material till it exudes in a clear transparent stream, slightly tinged with red. Each filtering cistern holds from forty to sixty bags, and in these are retained all the impurities before spoken of, except a little colouring matter to be removed by the next process.

You may be certain that the bags thus filled in their every pore with impurities soon become clogged up. The following is the mode in which they are cleansed. On a couple of little platforms stand a couple of men enveloped in canvas and steam, and their faces dappled with mud. Between them, attached to a pipe through which flows the waste steam from the boiler, is one of the dirty bags turned inside out from the





filter. A cock is turned on, the bag distends with steam, and the two men scrape off the filth from it like so much mud. When all the dirt that can be scraped off has been removed, the bag is detached from the steam-pipe and thrown towards another workman, who thoroughly washes it in hot lime-water. The bags are then taken into another room, where they are dried by a patent centrifugal machine. The product of these washings looks very like mere mud, or dark-coloured clay, but is far from being valueless. This mud or clay is bought by the scum-boilers, who submit it to a somewhat similar process to that which it has already undergone. The saccharine matter obtained is used principally by the blacking-makers, and sometimes by the manufacturers of lollipops and sweet-stuff for children; after which the residue is sold for manure, for which purpose it has sometimes brought fifteen dollars a ton! A glance at the engraving will render our description of the above processes somewhat clearer.

The next object to be attained is the decoloration of the clear transparent reddish liquid which we have seen to leave the filters. This is effected by means of the decolouring cisterns. Now it must be understood that the object of the sugar refiner is to remove the colouring matter from the "liquor" without either destroying its transparency or injuring its quality. For this purpose there is no agent so good as charcoal, and no charcoal so good as that obtained from the burning of bones. The intimate admixture of carbonate and phosphate of lime with pure carbon thus obtained, is called animal charcoal. To the discovery of the German chemist, Leibnitz, that common wood charcoal possesses the property of removing the colouring matter from many animal and vegetable substances, and to the further discovery, about forty years since, of M. Figure, that charcoal obtained from calcined bones was of much greater decolouring power, are owing many improvements in manufactures, not the least of which is the superior method of refining raw sugar. At the bottom of the filtering cistern is a false floor formed of laths a little distance apart. On this false bottom is laid a cloth which completely covers it; and on this a layer of powdered animal charcoal or "bone black" of three or four feet in thickness. The saccharine liquor from the filters flows into this cistern by means of pipes leading from one to the others; and in a few hours it percolates entirely through the charcoal bed and the layer of cloth; and, escaping through the false floor beneath, is carried off by means of a syphon pipe, a perfectly clear, transparent, and almost colourless liquid. The opaque heavy impurities were removed in the filters by means of the canvas bags, while the colouring matter has been almost entirely got rid of by this further filtration through the bed of animal charcoal. The perfect decoloration which has taken place fits the saccharine liquor for the next process, the boiling, by which the crystallisation or solidification is formed.

Of course the charcoal, like the canvas bags, becomes, after two or three operations, entirely filled with impurities. This is soon remedied; for in another part of the refiner's premises there are furnaces, iron retorts, etc., for re-burning the charcoal, after which it is as good as ever. Indeed, it may be said that—though it wastes, of course, in a slight degree—the power of the carbon is never destroyed, for some of it has been in use for more than twenty years. Thus, by purifying the charcoal, it may be used over and over and over again, *ad infinitum*.

The next process is that of boiling in the vacuum pans. The object of this process is two-fold. It has already been said, that in all raw sugars there is a certain quantity of uncrystallisable matter and water driven off in the form of steam. We will endeavour to explain. There are half a dozen circular, domed, air-tight copper vessels, like that represented in the engraving; each furnished with valves, taps, and pipes, for the various purposes of testing the temperature of the liquor, allowing the air drawn off by the air-pump to escape, admitting steam to the boiler, evaporating the steam, etc. etc. In fact, the vacuum boiler may be considered the great heart which sets all the other parts of this factory in motion, and to which all the other processes are subsidiary. Formerly, sugar

was boiled in large pans over an open fire, at a temperature of from 240° to 250° Fahrenheit, under ordinary atmospheric pressure. But it was found, notwithstanding the greatest care in boiling, that the sugar was injured by the high temperature employed, and only partial crystallisation could be obtained. The scion of an English noble house, some forty years ago, conceived the happy idea of boiling sugar in vacuo; that is, removing the pressure of the atmosphere by means of an air-pump, so that the operation of boiling—which is only rapid evaporation—could be carried on at a very low temperature. At first, of course, as with most improvements in manufactures and the arts, there were great difficulties to be overcome; the experiments on which the plan was based had been carried on with an insufficient apparatus, and the production of small, weak, soft crystals was the only result. At last an accident was the means of clearing away all doubts, as to the practical operation of the new plan. It is said that a sugar-refiner in England had so nearly ruined himself in his efforts to carry out the idea, that his son, a cleverer man than his father in many respects, withdrew from the business, and that the friends of the enthusiast were really thinking of issuing a commission of lunacy to prevent his wasting his substance. One day, however, while the gentleman in question was pondering the matter in his counting-house, one of his workmen, a German, rushed in with the exclamation, "I've found it out, sir; I've found it out." And so he had; for, while tending one of these vacuum pans, the liquor inside happened to get too hot; to remedy which he let in a quantity of cooler sugar, and on withdrawing a portion to examine its effect on the mass, to his astonishment he discovered that large bright crystals of sugar had formed in the pan. Another trial, and he was certain the real secret had been solved. And so it proved; and he who had been deemed a madman by his friends, and was almost ruined by his perseverance, lived to see his ideas prosper, and to become a rich man; and ever since then the plan of boiling sugar in vacuo has been universally adopted by the refiners.

The plan is this: the saccharine liquor, after percolating through the charcoal, and being afterwards collected in a cistern as a colourless transparent liquid, is brought through an ascending pipe into the pans themselves. From the pans the air has been withdrawn by an air-pump; and the liquid sugar rushes up the pipe to supply its place, as in a common pump. Steam is then admitted to the space below the sugar in the pan, and also through a number of pipes to the interior; and thus the sugar, by means of the nearly perfect vacuum created in the pan, is brought to a boiling state while at a temperature but little higher than that of a warm bath. To assist the more perfect evaporation of the sugar, it is made to flow through a large iron pipe partially filled with tubes, by which means the steam is condensed and the vacuum maintained. As it evaporates, the crystals of sugar are already forming in the pan. To test the state of the granulated sugar, there are attached to each pan a thermometer, a glass test-pipe showing the height of steam inside, an index, and a tap by which the progress of the liquor in the evaporating pipe may be discovered. But the most important instrument of all is the ingenious little brass stick, called the proof rod, which may be regarded as a kind of key which unlocks a valve in the body of the pan, and, after withdrawing a portion of the crystallised sugar, locks the valve again without disturbing the vacuum inside. To test the quality of the sugar, the "boiler," as the workman employed at the pans is called, takes a sample with the proof rod, in the way described; and discovers the degree of tenacity and granulation by taking a little between his finger and thumb. By these means, apparently so simple, but really requiring a vast deal of experience and natural tact, the sufficiency or insufficiency of the boiling is at once discovered. It is then either subjected to further boiling, or is at once let down through a valve in the pan, to the sugar heaters below. These "heaters," into which the sugar flows from the vacuum pans, were formerly called "coolers," and for this reason. The "liquor" was before boiled at a very high temperature, and the granulation took

place only when the liquid was brought to a lower. The crystallisation now takes place within the boiler itself, and, for the purpose of giving the mass greater consistency, it is raised in these "heaters" to a temperature of about 180°, while it was boiled at 130° or 135°. The sugar is kept continually stirred, to drive off, in the form of vapour, the superfluous water with which it is combined, and to give the future loaf a finer and firmer texture; this stirring is called, in the language of the workmen, "hauling" and "mixing." This, though a busy scene, is one which is easily comprehended. It is a fitter one, however, for the pencil to delineate than the pen to describe.

The liquor is now ready for the moulds in the filling room. Here an entirely new scene meets our view. Nearly the whole floor of a very large, square, stone-paved room is covered with conical iron moulds, about two feet in length and six inches in diameter at their large ends; the greater portion of which are standing close together, each one on its apex and supported by its neighbour, with here and there, in front, a mould standing on its base gives the necessary support to the whole. Before we have taken in the scene, we have to stand aside to let a labourer pass, who bears before him a large copper basin filled to the brim with the hot saccharine liquor. Others succeed him, some stripped to the waist, some clothed in trousers and a sort of flannel or loose Guernsey shirt. We watch their proceedings. From the copper coal-scoop-looking machine they fill the various moulds ranged in hundreds along the floor, without spilling a single drop. It being important to fill all the moulds at about the same temperature, it is arranged that a sufficient number of men shall be employed to "fill out" the contents of one sugar boiling in about half-an-hour. While some of the workmen are thus engaged at a sort of half run in passing from the heaters to the moulds and filling out, others are occupied with little iron instruments, shaped something like solid triangles set horizontally on handles, in stirring and scraping round the edges of the moulds to prevent any adhesion, and to diffuse the small crystals still forming equally through the liquid mass of sugar. A most surprising thing it is to see how the workmen contrive to carry the scoops of hot "liquor" from the heater, and fill up the moulds, without ever scalding themselves or spilling the contents. But experience in this, as in all other mechanical operations, is the great teacher.

The sugar loaves still contain a certain portion of molasses; though, by the various processes they have undergone, they have been deprived of their solid impurities, a portion of their water, and the greater part of their colouring matter. To get rid of this remnant is the object of the next process; so, after standing in the filling-room for about a couple of days, the moulds are carried upwards, from floor to floor, through a series of trap-doors.

Let us now see how this molasses or syrup is finally made to quit the refined sugar. The moulds, which give to the refined mass the well-known sugar-loaf shape, are of various sizes, but the mode of manipulation is the same with each. In the language of the refinery, *loaves* are the best, and *lumps* the commoner description of sugar. The smallest moulds contain as little as ten pounds, and the largest not less than two hundred and fifty. We will suppose that a sufficient degree of solidification has taken place; the next

process, then, is the washing, or netting, which takes place in an upper room with a large floor, covered all over with moulds, placed each one of them in an earthen jar. Here the washing takes place. The small opening at the apex of each conical mould is uncovered, and the loaf allowed to drain. But the draining does not entirely remove the syrup from the sugar, a small portion still remaining among the crystals and the coating of the loaf. To get rid entirely of that part of the syrup which is still left in the sugar, the loaves are washed in rather a peculiar way. Till latterly, the washing was performed by means of a stratum of fine white clay and water, which, being placed on the surface of the base of the loaf, was allowed to percolate through it, and carry the colouring matter with it. At present, however, the porous surface, or sponge, is made of sugar itself, instead of clay. The rough portion of the sugar being scraped off the base of other loaves, it is mixed with water, and applied in the way the clay used to be. This "magna" or mortar percolates through the sugar, and escapes through the hole in the apex of the mould, in the shape of a fine transparent syrup of a light brown colour. When this "magna" becomes dry, a solution of fine clear sugar is poured; and thus this process is repeated till the loaf has lost all trace of molasses and colouring matter, and rivals snow itself in whiteness and points of sparkling light. From room to room is this process repeated, according to the different qualities of sugar required. The syrup, in which there still remains a certain portion of crystallisable matter, is treated in the same way as raw sugar, till at last nothing remains but the liquid so well known to most of us, when children, as treacle, vast quantities of which are used by the cheap confectioners and the makers of what is called sweet-stuff.

Nothing now remains, therefore, but to prepare the loaves for sale, which last process is known in the factory as "brushing off," a term certainly not very applicable, seeing that no brush is used at all. When the "washing" or "netting"—making the sugar net, neat, or pure—is completed, the face of the loaf is made smooth by means of a scraper or sharp knife. After having remained some days in the mould, the loaf is finally released by a smart blow against a post standing up on the floor. But in spite of the most careful "washing," the point of the sugar loaf still remains in a somewhat soft and discoloured condition, to remove which it is carried to a machine, in which a couple of cutting knives revolve by the aid of a wheel, turned either by hand or steam. The apex of the loaf being introduced to these, is speedily shaved or trimmed into the form usually seen, an operation known in the factory as "turning off."

In the inferior kinds of refined sugar, the softened end is simply chipped off, which leaves the loaf in the shape of a truncated cone. The piece chipped off is either used as "magna," or is sold by the grocers under the name of "crushed crystallised West Indian sugar;" it has a light brown colour, and is scarcely inferior to the remainder of the loaf, except that it contains a small portion of molasses.

We had almost forgotten to say, that before the sugar is finally ready for sale it is papered up, and thoroughly dried in a stoving room, which is heated to a very high temperature by means of a series of iron pipes, through which the waste steam from the boiler is made to pass.

SPANISH MULETEERS.

For many years, one great obstacle to progress in Spain has been the non-existence of roads, rendering mules and muleteers indispensable. So severely is this defect, the consequence of bad government and internal dissensions, felt, that in certain districts wine, and good wine, is consumed on the spot at one-halfpenny per quart, for want of the means of conveyance. Mules can only carry small loads, especially when these loads are to be conveyed along the break-neck gullies so common in

Spain. Muleteers, then, still exist; and perhaps they are the only Spaniards who still carry the guitar on their backs. The sentimental age of serenaders has passed away everywhere, except upon the stage and in the novels of certain modern publishers, who like revivals of the antique. Figaro and Almaviva are mere fanciful portraits, which no more existed than Fra Diavolo or the Charles II. of Sir Walter Scott. The muleteer alone, who often follows the most diffi-